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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/887,777	06/22/2001	R. Bruce Doak	9138-0060	8709

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EXAMINER

HASSANZADEH, PARVIZ

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 08/05/2003

14

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-14

Office Action Summary

Application No.

09/887,777

Applicant(s)

DOAK ET AL

Examiner

Parviz Hassanzadeh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 June 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12-18 and 36-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12-18 and 36-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 12 is rejected under 35 U.S.C. 102(b) as being anticipated by Cappelli et al (Material Letters Vol. 31, 1997, pages 161-164).

Cappelli et al teach an apparatus (Fig. 1) for producing GaN (Gallium Nitride) film on a substrate, the apparatus comprising:

a pair of anode and cathode electrodes (*corona-discharge producing electrodes*) for generating direct current arc plasma;

a nitrogen gas source for introducing nitrogen as an arc source gas into a space between the electrodes (*a nitrogen delivery path leading to a location at which the electrodes produce a corona discharge*); and

a substrate mount supporting a substrate (*means to locate a substrate along the nitrogen delivery path downstream of the location at which the electrodes produce the corona discharge for deposition thereon of nitrogen activates by the corona discharge at a location sufficiently distant from the corona-discharge producing electrodes such that essentially the only activated nitrogen impinging on the substrate is $N_2A^3\Sigma_u^+$*).

The apparatus further includes an evaporative Ga-source for providing Ga vapor to the plasma to form GaN film on the substrate. (the entire of page 162).

The apparatus of Cappelli et al is inherently capable of being operated under the condition required for producing the excited state nitrogen as cited in the claim. It has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danley*, 120 USPQ 528, 531, (CCPQ 1959); "Apparatus claims cover what a device is, not what a device does" (Emphasis in original) *Hewlett-Packard Co. V. Bausch & Lomb Inc.*, 15USPQ2d 1525, 1528 (Fed. Cir. 1990); and a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). Also see MPEP 2114.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly

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owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hinchliffe (US Patent No. 5,821,548) in view of Cappelli et al (Material Letters Vol. 31, 1997, pages 161-164).

Hinchliffe teach an apparatus (Fig. 1) for depositing thin-film on a substrate, the apparatus comprising:

a corona electrode 40 disposed inside a nozzle tube ²⁴22 and positively biased skimmer 16 (*corona-discharge producing electrodes*) for generating corona discharge plasma 35;

a gas source 28 for introducing a gas such as nitrogen as an arc source gas into the nozzle tube 24 (*a nitrogen delivery path leading to a location at which the electrodes produce a corona discharge*); and

a substrate mount (not shown) supporting a substrate 22 (*means to locate a substrate along the nitrogen delivery path downstream of the location at which the electrodes produce the corona discharge for deposition thereon of nitrogen activates by the corona discharge at a location sufficiently distant from the corona-discharge producing electrodes such that essentially the only activated nitrogen impingent on the substrate is $N_2A^3\Sigma_u^+$*) (column 5, line 45 through column 6, line 33; column 7, lines 10-18; column 8, line 60 through column 9, line 10; column 9, lines 54-67).

Hinchliffe fails to teach a material source for forming a nitride film thereof.

Cappelli et al teach an apparatus (Fig. 1) for producing GaN (Gallium Nitride) film on a substrate, the apparatus comprising : a pair of anode (-) and cathode (+) electrodes for generating direct current arc plasma; a nitrogen gas source for introducing nitrogen as an arc source gas into

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a space between the electrodes; a substrate mount supporting a substrate; and an evaporative Ga-source for providing Ga vapor to the plasma to form GaN film on the substrate. (the entire of page 162).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the Ga-evaporator source as taught by Cappelli et al in the apparatus of Hinchliffe in order to produced a nitride film the substrate.

Further regarding claim 13: the apparatus of Hinchliffe includes a discharge nozzle 12 with a nitrogen emersion orifice in the nitrogen passageway 33 (*delivery path*), the corona electrode 40 being proximate the nitrogen emersion orifice of the nozzle 12 (Fig. 2), the skimmer electrode 16 (a second of the corona discharge electrodes) being spaced from the nitrogen emersion orifice of the nozzle and the first one of the corona discharge electrode, the skimmer 16 being located downstream of the nozzle 12 in the direction of nitrogen flow, the skimmer 16 defining an opening to collimate a beam of the activated nitrogen molecules passing therethrough, at least one chamber 23 downstream of the skimmer 16, a pump 80 (means for evacuating) for evacuating the chamber 23 for form *supersonic expansion* and to draw off gases other than activated nitrogen molecules prior to the activated nitrogen molecules reaching the substrate (also see column 9, lines 11-19).

Claims 14, 15, 17, 18 and 36-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hinchliffe (US Patent No. 5,821,548) in view of Cappelli et al (Material Letters Vol. 31, 1997, pages 161-164) as applied to claims 12, 13, 47-52 above, and further in view of Yamauchi et al (US Patent No. 6,207,951 B1).

Hinchliffe in view of Cappelli et al teach all limitations of the claims as discussed above except for the supersonic expansion chamber (*the at least one chamber*) including a plurality of succeeding chambers with means for evacuation (claim 14); or means for collimating the jet of nitrogen molecules (claim 36 and its dependent claims 37, 38).

Yamauchi et al teach a corona discharge apparatus (Fig. 1) for depositing material on the surface of a substrate. The apparatus includes a buffer chamber 9 and a high vacuum chamber 13 arranged between a skimmer 8 and a substrate 14, wherein the chambers 9 and 13 are pumped differentially by achieve ultra high vacuum in the chamber 13 where the substrate is located (column 5, lines 13-41). The two chambers are separated by a ultrahigh vacuum wall 15 having a hole 15a (means for collimating) through which plasma gas passes and impinges upon the substrate 14.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the ultra high vacuum wall and the hole as taught by Yamauchi et al in the apparatus of Hinchliffe in view of Cappelli et al in order to differentially achieve ultra high vacuum in the chamber where the substrate is disposed. Further It is held *in re Harza, 274 F.2d 669, 124 USPQ 378 (CCPA 1960)* that a mere duplication of parts has no patentable significance unless a new and unexpected result is produced therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add more differentially pumped chambers and perforated walls therebetween in order to achieve higher level of vacuum.

Further regarding claims 15, 17, 18: as shown in Fig. 2 of the apparatus of Hinchliffe, the discharge nozzle 12 form a nozzle orifice 20 at its end, the tube 24 being in the nitrogen passageway 33 (*delivery path*), the first one the corona-discharge electrode 40 being located

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within the tube 24, the second one of the corona-discharge electrode (skimmer 16) being located outside the tube 24, the nitrogen emergent from the tube 24 into a corona discharge 35 between the electrodes forming with the corona discharge 35 a corona discharge supersonic free-jet (column 5, line 45 through column 6, line 33; column 7, lines 10-18; column 8, line 60 through column 9, line 10; column 9, lines 54-67).

Further regarding claims 36-52: It is the Examiner's position that implementation of an additional gas source as well as a temperature controlling device would have been obvious for forming a desired film under a selected temperature condition.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hinchliffe (US Patent No. 5,821,548) in view of Cappelli et al (Material Letters Vol. 31, 1997, pages 161-164) and Yamauchi et al (US Patent No. 6,207,951 B1) as applied to claims 14, 15, 17, 18 and 36-52 above, and further in view of Bachir et al (Chemical Physics Letters Vol. 270, 1997, pages 533-537).

Hinchliffe in view of Cappelli et al and Yamauchi et al teach all limitations of the claims as discussed above except for the second of the corona-discharge electrodes being generally annular and surround the restricted end of the tube.

Bachir et al teach a corona discharge source (Fig. 1) wherein a hollow cylindrical cathode is used as the second of the corona electrode such that due to the large surface thereof sparking of the discharge to the grounded metallic part of the expansion chamber is prevented. For the purpose of the spectroscopic study of the corona discharge, the hollow cylinder cathode is located approximately 30 mm down below the orifice of the jet.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the corona-discharge cathode electrode as taught by Bachir et al in the apparatus of Hinchliffe in view of Cappelli et al and Yamauchi et al in order to prevent sparking of the discharge to the chamber walls. Further since the intended use of the apparatus of Hinchliffe in view of Cappelli et al and Yamauchi et al is not spectroscopic study the plasma, the hollow cylinder cathode may be arranged around the tube 24 rather than down stream where the skimmer 16 is located.

Response to Arguments

Applicant's arguments filed 6/17/03 have been fully considered but they are not persuasive.

Applicants assert that each of the independent claims 12 and 36 requires the substrate being at a location sufficiently distal from the corona-discharge producing electrodes such that essentially the only activated nitrogen impinging on the substrate is $N_2A^3\Sigma_u^+$.

The Examiner argues that a corona discharge can yield predominantly the long-lived metastable $N_2A^3\Sigma_u^+$ state through *supersonic jet expansion* rather than simply moving the substrate far from the corona electrode. Claim 12 does not recite a supersonic jet expansion unit coupled to the discharge unit in order to predominantly filter in the metastable $N_2A^3\Sigma_u^+$ state to the substrate.

Furthermore, the apparatus of Hinchliffe includes a molecular beam skimmer 16 and additional set of deflection optics may be added to the system to further preclude positive ions from entering the plasma beam. Thus, the system includes a *supersonic corona discharge nozzle*

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which would produce predominantly metastable $N_2A^3\Sigma_u^+$ state from nitrogen gas source (column 8, line 60 through column 9, line 53).

Applicants assert Cappelli et al teach an “arc discharge” rather than a “corona discharge”, wherein the two discharge system are structurally somewhat similar, but they operate in different pressure, current and voltage.

The Examiner argues that the discharge system of Cappelli et al is structurally similar to the claimed apparatus and is capable of being operated under the condition required for generating corona discharge. It has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danley*, 120 USPQ 528, 531, (CCPQ 1959); “Apparatus claims cover what a device is, not what a device does” (Emphasis in original) *Hewlett-Packard Co. V. Bausch & Lomb Inc.*, 15USPQ2d 1525, 1528 (Fed. Cir. 1990); and a claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). Also see MPEP 2114.

The Applicants assert that the discharge electrode being cathode as recited in claim 13.

The Examiner argues the inner electrode of Cappelli et al is cathode (-) and the inner electrode of Hinchliffe is anode (+), thus, one of ordinary skill in the art would have recognized that either a positive or negative voltage may be applied to the inner electrode to produce a discharge.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kurihara et al (US Patent No. 5,403,399) teach an arc plasma source formed of concentric anode and cathode electrodes for chemical vapor deposition;

Spruck (US Patent No. 3,283,120) teach an electron beam comprising a cathode 1 surrounded by a control cylinder 2;

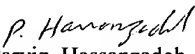
Parker et al (US Patent No. 5,165,954) teach a system for producing a precisely focused ion beam employing a plurality of ion lenses.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (703)308-2050. The examiner can normally be reached on Tuesday-Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703)308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703)872-9310 for regular communications and (703)872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.


Parviz Hassanzadeh
Primary Examiner
Art Unit 1763

July 31, 2003